

HOME MANAGEMENT OF OSTEOMYELITIS*

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DURING the late 1970s dramatic changes were occurring in the health care industry in the United States. Although inflation was high in the country as a whole, the price of health care was skyrocketing; within a five year period the proportion of the gross national product attributable to health care had risen from 8 to 12%.¹ Furthermore, the indigent patient burden was dramatically escalating, and improvements in diagnostic techniques and therapeutic interventions had increased life expectancy for those surviving the neonatal period.²

Primarily due to the economic potential of medicine as an industry, for-profit hospitals emerged as competitors to the traditional nonprofit sector. Resulting competition caused health care management to analyze costs in new ways. The ancillary services in a hospital, such as radiology, laboratory, and rehabilitation medicine, were extremely profitable, and helped to subsidize inpatient room charges. An oversupply of medical school graduates and the emergence of physician entrepreneurs resulted in the advent of comprehensive outpatient surgical and clinical facilities, which entered into direct competition with tertiary care centers in the more profitable areas of medicine.

The most significant development in cost containment was the application of new actuarial techniques to rapidly rising health care costs. Health maintenance organizations, or HMOs, offered employers true cost containment as they provided health care for a fixed fee. These organizations either contracted with or hired the medical talent necessary to accomplish their task, while instituting strict guidelines for the consumption of expensive tests and procedures.

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The federal government, through Medicare, the nation's largest insurer, was frustrated by an unwillingness on the part of tertiary care hospitals to institute similar cost containment guidelines. Prospective payment was introduced, utilizing a system of diagnosis-related groups, or DRGs, which fixed the reimbursement to the hospital for each patient at the time of admission. The theory was that efficiency would become mandatory for hospitals to compete and survive.³ Many major expense areas were re-evaluated. In particular, available therapies for osteomyelitis and endocarditis, four to six weeks of parenteral antibiotics, created a tremendous financial incentive for research and development of less expensive alternatives.

HOME HEALTH CARE

One consequence of increased competition in ancillary services and prospective payment was the development of the home health care industry. Specifically, there were numerous clinical situations where patients remained in hospital solely to receive medications, therapies, and nursing supervision which could be provided at home, with routine physician's office visits to monitor the patient's progress. Intravenous administration of antibiotics to ambulatory patients, whose clinical signs and symptoms were such as to enable a weekly assessment, remains a principal activity of home health care agencies.⁴

OSTEOMYELITIS

Osteomyelitis is a deep seated infection, treatment of which usually consists of surgical intervention and/or sequestrectomy at the wound site, followed by a possibly prolonged course of antibiotics. The organisms most responsible for osteomyelitis are *Staphylococcus aureus* and *Pseudomonas aeruginosa*, which accounts for more than 50% of all cases.⁵ Antibiotic treatment regimens for osteomyelitis often last longer than four weeks. Aminoglycosides administered for this length of time are associated with increased toxicity, and thus the third generation cephalosporins, with their broad spectrum of activity and low toxicity, have become agents of choice for treatment of osteomyelitis.

Shown in Table I is a summary of our experience in treating osteomyelitis patients with a single treatment regimen, either a third generation cephalosporin alone, ticarcillin/clavulanic acid alone, a ureidopenicillin-aminoglycoside combination, or an oral quinolone alone for four to six weeks. Our data reveal that a ureidopenicillin-aminoglycoside combination was not

TABLE I: RESULTS OF SINGLE TREATMENT REGIMEN FOR OSTEOMYELITIS*
(EXPRESSED AS SUCCESSES/PATIENTS (RESISTANT ORGANISMS))

	<i>3rd-generation cephalosporin</i>	<i>Ticarcillin/ clavulanic ac</i>	<i>Penicillin+ aminoglycoside</i>	<i>Oral quinolone</i>
S. aureus	10/12 (1)	10/10	0/ 0	11/11
Other Gram- positive cocci	12/12	4/ 4	2/ 2	1/ 1
P. aeruginosa	8/ 8	1/ 1	14/14	10/12 (2)
Other Gram- negative rods	10/16 (3)	3/ 5 (1)	2/ 4	13/15 (1)
S. aureus+				
P. aeruginosa	8/10 (2)	3/ 3	2/ 4 (1)	3/ 4 (1)
S. aureus+				
Other pathogen	8/ 8	5/ 6 (1)	0/ 0	2/ 3
P. aeruginosa+				
Other pathogen	1/ 1	3/ 3	0/ 0	4/ 5 (1)
Other polymic.	0/ 2 (1)	1/ 3 (1)	2/ 2	0/ 0
Overall	57/69 (7) 83% (10%)	30/35 (3) 86% (9%)	22/26 (1) 85% (4%)	44/51 (6) 86% (12%)

*Gentry, L.O., 1987. Unpublished data.

34 patients were started on a ureidopenicillin-aminoglycoside combination, yet were switched to a third-generation cephalosporin due to adverse reactions to the initial therapy. Because these patients received a combination of agents, they are excluded, as were 103 other patients who received various mixed agents as therapy for the osteomyelitis.

The data are not a randomized comparison of the different types of agents; rather, each patient participated in a randomized comparison of two specific agents. A cursory review of the populations reveals no significant differences in the study groups that received the different types of agents. Long-term follow-up data are not yet available for the oral quinolone, ciprofloxacin.

tolerated for the entire duration of therapy by 34 of the 60 patients (57%) who began that therapy. Since other types of agents are as effective with much lower toxicity, we no longer routinely use that combination. Also, we no longer use an aminoglycoside as empiric therapy due to the side effects encountered with prolonged use.

Our data reveal single-agent therapy, appropriately chosen, to be equally effective as mixed or combination therapies. Our patients were diagnosed by bone biopsy. If necessary, surgery was performed to insert a catheter to allow self-administration of parenteral antibiotics and the patients were discharged to home therapy through self-administration. All three single-agent therapies were well tolerated in home care, and no consistent difficulties due to home use were encountered. In fact, no patients were unable to complete the home treatment regimen. Third-generation cephalosporins are quite active against most pathogens that cause osteomyelitis. While third generation cephalosporins have become the agents of choice for most osteomyelitis, their high cost has become an issue.

INDICATIONS

Patients undergoing antibiotic therapy for osteomyelitis are often ambulatory and otherwise well throughout the treatment regimen. Home health care is a definite consideration for our osteomyelitis patients in no immediate distress from the infection itself, and who, with the assistance of family members, can self-administer the antibiotics through a Broviac or Hickman vascular access catheter. This catheter is surgically inserted in the hospital to ensure patient safety during long-term intravenous administration. Our osteomyelitis patients need only to return to the clinic every two weeks for re-examination, wound site culture when indicated, and laboratory analysis.

ECONOMICS

Presented in Table II are the cost estimates for inpatient versus home care for osteomyelitis patients at our institution. It is very significant that more than a 50% reduction in costs is realized through the use of home care.⁶ If the patient is a Medicare patient, these savings directly contribute to the hospital, whereas if an HMO or insurance company is reimbursing the hospital for the charges, that company benefits. In either case, more efficient uses of health care resources benefit society as a whole. Also shown in Table II are other economic advantages to the prudent use of home care in the management of osteomyelitis. Although it is difficult to extrapolate an exact fiscal contribution of these factors, they nonetheless contribute to the conclusion that home management is an integral component to the treatment of osteomyelitis.

BENEFITS

Surveys have shown that patients strongly prefer family life to hospital routine, and that even with the rigors of multiple daily administrations of antibiotics, home care is preferable to hospitalization. Although definitive data are not available, the risk of infection due to Gram-negative organisms such as *P. aeruginosa*, indigenous to many tertiary-care centers, should be lessened through home therapy. While there is certainly an increased risk of Gram-positive vascular access catheter site infections in home care, methicillin-resistant strains of *S. aureus* are generally hospital associated and should not be present in the home environment.

ORAL ANTIBIOTICS

Probably the most important impact on the treatment of osteomyelitis will be the availability of oral antibiotic therapy for osteomyelitis. These agents

TABLE II. ECONOMIC COMPARISON OF INPATIENT AND HOME CARE.

<i>Standard six-week treatment (inpatient care or home care)*</i>	
X-ray directed open bone biopsy	
Cultures (×2)—aerobes and anaerobes	
Broviac catheter insertion	
Laboratory (×3)—complete blood count, differential, urinalysis, SMA-12	
Third generation cephalosporin (e.g., ceftizoxime)	
Fixed charge for both groups	\$6,830
<i>Inpatient care</i>	
Daily room (×42) at \$150/day	
Physician care (×42) at \$40/day	
Inpatient care charge	\$7,980
<i>Home care</i>	
Home visits (×8) at \$50/visit	
Clinic visits (×3) at \$60/visit	
Home care charge	\$ 580
<i>Price differential (Inpatient care—home care)</i>	\$7,400

*All prices reflect the room rates, standard physician's fees, pharmacy charges, and home care costs for St. Luke's Episcopal Hospital, Houston, Texas, and subsidiary organizations

Also, the patient's earlier return to productivity due to the use of homecare results in reduced disability payments by employer and increased income tax payments to government.

must demonstrate activity against *S.aureus* and *P.aeruginosa* and have low toxicity. Obviously, patients will not require prolonged hospitalization or vascular access catheter insertion. Not only will the drug costs be decreased, possibly \$200 for a six week supply versus more than \$4,000 for a third generation cephalosporin, but all the majority of osteomyelitis patients should be eligible for oral therapy and not require prolonged parenteral therapy.

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